*'802* (JP71002802B) and *JP '975* (JP81006975B). Claims 11-12 were rejected under 35 U.S.C. § 103(a) as being unpatentable over *Fache et al* in view of *BE '237*, and further in view of *Dougherty et al* (U.S. Patent No. 3,933,930). For the reasons set forth below, these rejections should be withdrawn.

The present invention, as defined by claim 1, relates to a process for treating the reaction mixture resulting from the direct oxidation of cyclohexane to adipic acid with molecular oxygen in an organic solvent in the presence of a catalyst. The process comprises the steps of (a) separating the reaction mixture into two liquid phases by settling to form an upper phase comprising cyclohexane, and a lower phase comprising an organic solvent, diacids formed during the oxidation reaction, a catalyst and a portion of other reaction products and unconverted cyclohexane; (b) distilling the lower phase to provide (i) a distillate comprising at least a portion of the most volatile compounds and (ii) a distillation bottoms comprising the diacids formed and the catalyst; (c) separating the catalyst from the distillation bottoms; (d) conducting a reducing and/or oxidizing purification treatment of the adipic acid in an aqueous solution; (e) crystallizing the adipic acid from water, preceding or following purification step (d), if crystallization has not been carried out in order to separate the catalyst from the distillation bottoms; and (f) recrystallizing the adipic acid from water.

*Fache et al* discloses a method of processing reaction mixtures obtained from the oxidation of cyclohexane. The method of *Fache et al* comprises three primary steps: distillation; addition of water; and crystallization.

The present invention is an improvement to the process disclosed by *Fache et al*. This improvement can provide adipic acid in high purity and with good coloration.

*Fache et al* does not disclose or suggest each of the features of the presently claimed invention. For example, *Fache et al* does not disclose or suggest step (d), conducting a reducing and/or oxidizing purification treatment of the adipic acid in an aqueous solution. This purification step can take the form of hydrogenation and/or treatment with nitric acid and/or oxidation using molecular oxygen, ozone or hydroperoxide. See, e.g., claim 10 and the specification at page 8, line 5 to page 10, line 16. Thus, *Fache et al* clearly fails to disclose or suggest each of the features of the presently claimed invention.

*BE '237* does not remedy the deficiencies of *Fache et al*. *BE '237* discloses a combination of two treatments for purifying adipic acid. One is treatment with nitric acid, and one with activated charcoal. The adipic acid is obtained by oxidation of cyclohexane with nitric acid.

***BE '237* cannot be properly combined with *Fache et al*.** The process for producing adipic acid in *BE '237* is quite different from the process for producing adipic acid in *Fache et al*. *BE '237* produces adipic acid by oxidation of cyclohexane with nitric acid. In contrast, *Fache et al* produces adipic acid by direct oxidation of cyclohexane with oxygen in an organic solvent and in the presence of a catalyst. The two reactions are quite different and yield different reaction mixtures. For example, oxidation by nitric acid produces various nitrous compounds while oxidation by oxygen does not. See, e.g., *Fache et al* at col. 1, lines 11-17. Moreover, the catalyst used in nitric oxidation is different from

the catalyst used in direct oxygen oxidation. As a result, it would not have been obvious for one of ordinary skill in the art to combine the teachings of *BE '237* with those of *Fache et al* because *BE '237* does not teach that adipic acid from direct oxygen oxidation in *Fache et al* can be purified by an oxidation treatment like the nitric acid treatment disclosed in *BE '237*, which contains impurities different from the adipic acid of *Fache et al*.

Applicants note the assertion in the Official Action that it would have been obvious to persons skilled in the art to include additional known purification steps of oxidation or reduction "in order to increase the purity of the obtained adipic acid." However, this assertion is not supported by the applied references. Nothing in the applied references teaches or suggests that oxidizing or reducing already crystallized adipic acid obtained from direct oxygen oxidation would increase the purity of the final adipic acid product.

As already noted, *BE '237* deals with adipic acid obtained by nitric acid oxidation while *Fache et al* does not. Thus, *BE '237* does not lead persons skilled in the art to believe that the purity of adipic acid obtained from a different process (*i.e.*, one that does not involve the use of nitric acid) can be increased by a treatment with nitric acid. Indeed, there is simply no reason for persons skilled in the art to carry out nitric acid treatment on adipic acid that was not obtained from nitric acid oxidation of cyclohexane. Why would persons skilled in the art introduce a component into a system that would have to be separated out later and that may produce unwanted by-products such as nitrogen oxides? In this regard, GB 1,576,297 (which corresponds to *BE '237*) notes that "[t]he new process has the advantage that it is not necessary to use any solvents which subsequently have to be purified." Page 2, lines 8-10. That is an advantage in the *BE '237* process because it uses

nitric acid in the production process and can re-use the nitric acid there without purification. In contrast, *Fache et al* does not use nitric acid in its production process. Thus, it does not share the same advantage. As a result, persons skilled in the art would not have any incentive to use nitric acid to purify the adipic acid of *Fache et al*.

With respect to *JP '802*, it does not teach that blowing molecular oxygen into an aqueous solution of adipic acid would increase the adipic acid's purity. Thus, persons skilled in the art would have no reason to use it in the process of *Fache et al*.

With respect to *JP '975*, contrary to the assertion in the Official Action, it does not even deal with adipic acid purification. *JP '975* simply discloses that the purity of adipic acid produced by nitric acid oxidation of cyclohexanol and cyclohexanone can be improved if the oxidation were carried out with hydrogen peroxide. The reference does not talk about using hydrogen peroxide to purify adipic acid that is already formed. Thus, *JP '975* has little relevance to the present invention and cannot be combined with the other applied references to arrive at the claimed invention.

Finally, with respect to *Dougherty et al*, contrary to the suggestion made in the Official Action, it does not deal with purifying adipic acid at all. The desired product in that reference is 1,6-hexanediol, and the hydrogenation step referred to by the Examiner actually deals with improving the efficiency and purity of the ultimate product, which is 1,6-hexandiol. Col. 6, lines 36-39 and col. 7, lines 12-17. Like *JP '975*, this reference has little relevance to the present invention and cannot be combined with the other applied references to arrive at the claimed invention.

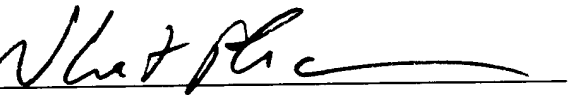
Accordingly, for at least all of the reasons set forth above, the applied references cannot be properly combined to disclose or suggest each of the features of the presently claimed invention. Therefore, there is no *prima facie* case of obviousness, and the rejections under 35 U.S.C. § 103(a) should be withdrawn.

From the foregoing, further and favorable action in the form of a Notice of Allowance is believed to be next in order, and such action is earnestly solicited.

If the Examiner has any questions concerning this Reply, or the application in general, the Examiner is invited to telephone the undersigned at the number listed below.

Respectfully submitted,

BURNS, DOANE, SWECKER & MATHIS, L.L.P.

By: 

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